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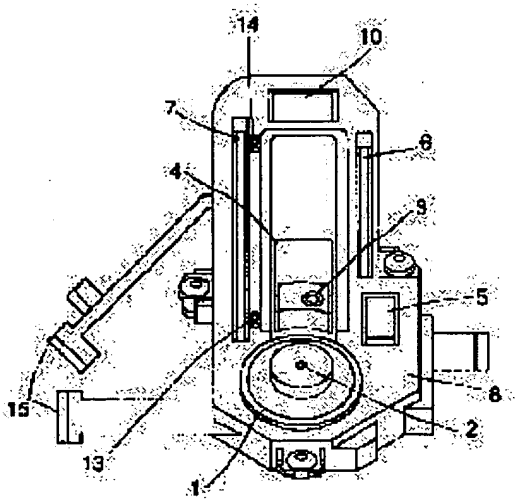
FUKUEDA YOSHINOBU

(54) OPTICAL DISK REPRODUCING METHOD AND OPTICAL DISK DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To stably read out information from an optical disk.

SOLUTION: An inclination of the optical disk is detected by a tilt sensor 13 provided in an inner circumference and a tilt sensor 14 provided in an outer circumference. An inclination of each part of the optical disk is calculated in direction and degree from a result of detecting this inclination in inner circumferential and outer circumferential positions (addresses) so as to be predictive. Thus, by moving an objective lens 3 for the purpose of reproducing information at an address, and at the same time, by driving a tilt servo motor 10 in accordance with an inclination in the position at these addresses based on the predicted calculation result, a deviation from perpendicularity between an optical axis of the objective lens 3 and a reflecting surface of the optical disk is corrected, and hence the information can stably be read out of the optical disk.



LEGAL STATUS

[Date of request for examination]

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[Date of final disposal for application]

[Patent number]

[Date of registration]

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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] The 1st inclination detection step which detects the gap with the vertical axes over the field of an optical disk and the optical axis of an objective lens in the inner circumference part of an optical disk, The 2nd inclination detection step which detects the gap with the vertical axes over the field of an optical disk and the optical axis of an objective lens in the periphery part of an optical disk, The radius location inclination calculation step which computes the inclination of two or more radial locations based on the inclination of the inner circumference part obtained at said 1st inclination detection step, and the inclination of the periphery part obtained at said 2nd inclination detection step, Said radius location inclination detection step is performed rotating an optical disk. It has the perimeter location inclination calculation step which computes the inclination of the optical disk perimeter. The optical disk playback approach characterized by amending the inclination of the optical axis of said objective lens with reference to the inclination of an applicable location from the inclination of the optical disk perimeter obtained at said perimeter location inclination calculation step when moving an objective lens, in order to reproduce the information on a certain location on an optical disk.
[Claim 2] The optical disk rotation driving means which lays an optical disk and is rotated, and an optical reading means to make an optical disk side carry out image formation of the light which irradiates an optical disk, to condense the reflected light from an optical disk, and to change into an electrical signal, A migration means to move said optical reading means to radial [of an optical disk], The 1st inclination detection means which is arranged among the successive ranges of said migration means at an inner circumference part, and detects the gap with the vertical axes over the field of an optical disk, and the optical axis of said optical reading means, The 2nd inclination detection means which is arranged among the successive ranges of said migration means at a periphery part, and detects the gap with the vertical axes over the field of an optical disk, and the optical axis of said optical reading means, The optical disk unit characterized by having an inclination storage means to compute and memorize radial [of an optical disk], and the inclination of each location of the perimeter enclosure, based on said rotation driving means, said 1st inclination detection means, and the 2nd inclination detection means.
[Claim 3] Said inclination storage means is an optical disk unit according to claim 2 characterized by computing and memorizing the inclination of each location when reproducing a TOC field first after loading with an optical disk.
[Claim 4] The optical disk unit according to claim 2 characterized by to operate said inclination amendment means at the same time it operates said migration means, when reproducing the information on the location which has an inclination amendment means to amend a gap of the optical axis of said optical reading means according to the inclination of the applicable location for which it asked from said inclination storage means, and has an optical disk.
[Claim 5] Said inclination amendment means is an optical disk unit according to claim 4 characterized by moving the interior material of a proposal used for migration of said migration means, and amending a gap of the optical axis of said optical reading means.

[Claim 6] Said inclination amendment means is an optical disk unit according to claim 4 characterized by moving the inclination of the revolving shaft of said optical disk rotation driving means migration means, and amending a gap of the optical axis of said optical reading means.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the optical disk playback approach and optical disk unit which can amend the gap with the optical axis of an objective lens, and the plumbness of the reflector of an optical disk in information read-out from optical disks, such as a videodisk, and a compact disk, a magneto-optic disk, or the optical disk unit which performs the information writing to an optical disk.
[0002]
[Description of the Prior Art] Drawing 8 is the perspective view of the conventional optical disk unit. In drawing 8 , it explains that it is the configuration which can amend the gap with the optical axis of an objective lens, and the plumbness of the reflector of an optical disk.
[0003] The conventional optical pickup module has a rotation system and optical system. And a rotation system carries an optical disk on a turntable 1, and rotates a shaft 2 as a core. Moreover, the main shaft 6 and the guide shaft 7 which are the carriage 4 which carries the optical system mentioned later and moves to radial [of an optical disk], the feed motor 5 which makes carriage 4 drive, and the guide to which carriage 4 is moved are attached on the base 8.
[0004] Moreover, optical system has tilt sensor A9 attached on carriage 4, in order to detect the objective lens 3 for reading the recording information of an optical disk, and the inclination of an optical disk. And by the signal from tilt sensor A9, in order to amend the gap with the optical axis of an objective lens 3, and the plumbness of the reflector of an optical disk, the tilt servo motor 10 is attached on the base 8.
[0005] In order to amend the gap with the optical axis of an objective lens 3, and the plumbness of the reflector of an optical disk, with the tilt servo motor 10, a main shaft 6 and the guide shaft 7 may be moved to coincidence, the inclination of an objective lens 3 may be amended, or with the tilt servo motor 10, a turntable 1 may be moved and the surface of revolution of an optical disk may be amended.
[0006] Next, detect the inclination of an optical disk, the tilt servo motor 10 is made to drive, and a process until it performs read-out of the information on an optical disk is explained. Drawing 9 is a flow chart which amends the conventional inclination and performs information read-out. Suppose that informational read-out is performed first in the location with an optical disk in drawing 9 (S1). Then, the instruction "perform read-out of the information on other locations" is given (S2). Then, naturally the feed motor 5 is operated and the carriage 4 carrying the objective lens 3 which performs informational read-out is moved to a position (S3).
[0007] Next, the inclination of the optical disk in the location near the part which is performing informational read-out by tilt sensor A9 on carriage 4 is detected (S4). And based on the detected inclination, the drive instruction of what amount to amend in which direction is given to the tilt servo motor 10 (S5). in order [then,] for the tilt servo motor 10 to drive with the drive instruction and to amend the gap with the optical axis of an objective lens 3, and the plumbness of the reflector of an optical disk -- carriage 4 -- or a turntable 1 is moved (S6). Consequently, read-out of the information on the position of an optical disk can be performed (S7).

[0008] The detection system of the inclination of the optical disk using a common tilt sensor is explained here. Drawing 10 is the detection optical-path Fig. of the conventional tilt sensor, drawing 11 is the top view of the lens focal plane of drawing 10 , and drawing 12 is the side elevation of drawing 10 . In drawing 12 , infrared radiation LED 11 is used for the light source from drawing 10 . An optical disk is irradiated to the diffused light by which outgoing radiation was carried out from infrared radiation LED 11 through a lens, the reflected light is again condensed with a lens, and image formation of the real image of infrared radiation LED 11 is carried out on 2 division photodetector 12. A real image changes a location on 2 division detector 12 with the inclination of an optical disk, and the inclination of an optical disk is detected as a difference of the output of each sensing element of 2 division detector 12. If especially infrared radiation LED 11 and 2 division photodetector 12 are arranged in the focal location of a lens, the condition of the reflector of an optical disk can detect only the inclination of an optical disk purely independently.

[0009]

[Problem(s) to be Solved by the Invention] Drawing 13 is drawing showing the gestalt of the "curvature" of an optical disk. Generally, as a gestalt of the curvature of an optical disk, it has curved like drawing 13 (a) by attachment and detachment of an optical disk in most cases. A flat surface is maintained mostly and, more specifically, as for the inner circumference section, in the periphery section, the inclination of curvature becomes large. As the gestalt of other curvatures is shown in drawing 13 (b), what curved contrary to (a), and the thing which curved to hard flow for every semicircle like drawing 6 (C) exist.

[0010] Therefore, while detecting these curvatures by one of tilt sensor A9 prepared in carriage 4, it was difficult to detect curvature to a periphery part.

[0011] Furthermore, since the location of an objective lens and the location of a tilt sensor are the radius top homotopics of an optical disk, the above-mentioned conventional optical disk unit needs to detect the inclination of an optical disk in an instant using a tilt sensor synchronizing with reading of information, and needs to amend the gap with the plumbness of the optical axis of an objective lens, and the reflector of an optical disk with the detection signal in an instant. Therefore, a tilt sensor with very sufficient responsibility and a drive servo are required, and needed the expensive sensor and the servo circuit.

[0012] If the recording density of an optical disk increases especially, it is necessary to amend the inclination of an optical disk with high precision, and the cheap and highly precise sensor and the servo circuit are demanded.

[0013] It aims at offering the optical disk playback approach and optical disk unit which this invention solves the above-mentioned conventional trouble, are stabilized, and can reproduce the information from an optical disk.

[0014]

[Means for Solving the Problem] In order to attain this purpose, the optical disk unit of this invention detects the inclination of an optical disk by the tilt sensor B in which it was prepared by inner circumference, and the tilt sensor C formed in the periphery. And it constitutes from a detection result of the inclination in each location (address) of inner circumference and a periphery so that the direction of the inclination of each part of an optical disk and the degree of an inclination may be calculated and it may predict beforehand.

[0015] In this way, by driving a tilt servo motor according to the inclination of the location of the applicable address, and applying amendment based on the result of an operation predicted beforehand, at the same time it moves an objective lens, in order to reproduce the information on a certain address The optical disk unit which it is stabilized and can perform read-out of the information from an optical disk can be offered without amending the gap with the optical axis of an objective lens, and the plumbness of the reflector of an optical disk, and needing a high speed and a highly precise servo.

[0016]

[Embodiment of the Invention] The 1st inclination detection step to which invention of this invention according to claim 1 detects the gap with the vertical axes over the field of an optical disk and the

optical axis of an objective lens in the inner circumference part of an optical disk, The 2nd inclination detection step which detects the gap with the vertical axes over the field of an optical disk and the optical axis of an objective lens in the periphery part of an optical disk, The radius location inclination calculation step which computes the inclination of two or more radial locations based on the inclination of the inner circumference part obtained at the 1st inclination detection step, and the inclination of the periphery part obtained at the 2nd inclination detection step, Perform a radius location inclination detection step, rotating an optical disk, and it has the perimeter location inclination calculation step which computes the inclination of the optical disk perimeter. In order to reproduce the information on a certain location on an optical disk, when moving an objective lens It is supposed that the inclination of the optical axis of an objective lens is amended with reference to the inclination of an applicable location from the inclination of the optical disk perimeter obtained at the perimeter location inclination calculation step. It has the operation referred to as being able to offer the optical disk playback approach which it is stabilized and can perform read-out of the information from an optical disk.

[0017] Invention according to claim 6 from claim 2 of this invention The optical disk rotation driving means which lays an optical disk and is rotated, and an optical reading means to make an optical disk side carry out image formation of the light which irradiates an optical disk, to condense the reflected light from an optical disk, and to change into an electrical signal, A migration means to move an optical reading means to radial [of an optical disk], The 1st inclination detection means which is arranged among the successive ranges of a migration means at an inner circumference part, and detects the gap with the vertical axes over the field of an optical disk, and the optical axis of an optical reading means, The 2nd inclination detection means which is arranged among the successive ranges of a migration means at a periphery part, and detects the gap with the vertical axes over the field of an optical disk, and the optical axis of an optical reading means, It is based on a rotation driving means, the 1st inclination detection means, and the 2nd inclination detection means. It is characterized by having an inclination storage means to compute and memorize radial [of an optical disk], and the inclination of each location of the perimeter enclosure. The above-mentioned inclination storage means It is characterized by computing and memorizing the inclination of each location, when reproducing a TOC field first after loading with an optical disk. Moreover, when reproducing the information on the location which has an inclination amendment means to amend a gap of the optical axis of an optical reading means according to the inclination of the applicable location for which it asked from the inclination storage means, and has an optical disk It is characterized by operating an inclination amendment means at the same time it operates a migration means. The above-mentioned inclination amendment means further again The interior material of a proposal used for migration of a migration means is moved, and it is characterized by amending a gap of the optical axis of an optical reading means. Again an inclination amendment means It is the optical disk unit characterized by moving the inclination of the revolving shaft of an optical disk rotation driving means migration means, and amending a gap of the optical axis of an optical reading means. It has the operation referred to as being able to offer the optical disk playback approach which it is stabilized and can perform read-out of the information from an optical disk.

[0018] Hereafter, the gestalt of operation of this invention is explained based on drawing.

(Gestalt of operation) The example of this invention is explained below. Drawing 1 is the perspective view of the optical disk unit in the gestalt of 1 operation of this invention. drawing 1 -- setting -- 1 -- a turntable and 2 -- a shaft and 3 -- for a feed motor and 6, as for a guide shaft and 8, a main shaft and 7 are [an objective lens and 4 / carriage and 5 / the base and 10] tilt servo motors. In addition, since these components are the same as each component of the conventional optical disk unit shown in drawing 8 , they attach the same sign and omit duplication of explanation.

[0019] As a characteristic configuration of this invention, the tilt sensor B13 is arranged on the base 8 at the location by the side of the inner circumference of an optical disk, and the tilt sensor C14 is arranged in the location by the side of a periphery. In order to amend the gap with the optical axis of an objective lens 3, and the plumbness of the reflector of an optical disk, based on the signal of the tilt sensor B13 and the tilt sensor C14, the tilt servo motor 10 may be operated, a main shaft 6 and the guide shaft 7 may be moved to coincidence, the inclination of an objective lens 3 may be amended, or with the tilt servo

motor 10, a turntable 1 may be moved and the surface of revolution of an optical disk may be amended. In addition, although the publication in drawing 1 was omitted, the contents of amendment control in the calculation list of the necessary controlled variable for amending a gap of the above-mentioned are contained by the electrical circuit (illustration abbreviation) connected with the signal cable 15.
[0020] Drawing 2 is a flow chart which amends the inclination in the gestalt of 1 operation of this invention, and performs information read-out. Next, the process in which amend the inclination in this invention based on drawing 2 , and information read-out is performed is explained.
[0021] First, an optical disk is carried on a turntable 1 (S11). Next, a TOC lead is performed in the location of the most inner circumference of an optical disk (S12). Moreover, to coincidence, using the tilt sensor B13 and the tilt sensor C14 which have been arranged on the base 8, it synchronizes on the inner circumference and the periphery of an optical disk, and the inclination of an optical disk is measured (S13). By calculating the inclination of the inner circumference of an optical disk and the periphery which were measured, the inclination of each location (address) of every of an optical disk is computed (S14). Actuation from the above step 11 to step 14 is actuation of a preparation phase.
[0022] Next, in the location (address) with an optical disk, while performing read-out of current information (S15), the instruction "perform read-out of the information on other locations (address)" should be received (S16). Then, the feed motor 5 is driven and the carriage 4 carrying an objective lens 3 is moved to a position (S17).
[0023] Since migration and coincidence of carriage understand the location (address) of a migration place, they understand the inclination of the optical disk in the location (address) of a migration place based on the result calculated at step 14 from step 11 (S18). Therefore, drive instruction what amount to amend in which direction is given to the tilt servo motor 10 (S19). Then, the tilt servo motor 10 drives, and in order to amend the gap with the optical axis of an objective lens 3, and the plumbness of the reflector of an optical disk, carriage 4 or a turntable 1 is moved (S20). Consequently, read-out of the information on the position of an optical disk is performed (S21).
[0024] By calculating the inclination of the inner circumference of the measured optical disk in step 18 and step 19 and a periphery here explains how to compute the inclination of the optical disk of each location (address) of every of an optical disk. Drawing 3 is drawing showing the relation between the radius location of an optical disk, and the address. In drawing 3 , when performing a TOC lead in the most inner circumference of an optical disk, the linear velocity of the optical disk is detected with a linear-velocity detection means. therefore, the location where the address in a periphery (location which can detect the tilt sensor C14) synchronizes with the address (a1-a100) in the location which can detect the above-mentioned tilt sensor B13 supposing the addresses in inner circumference (location which can detect the tilt sensor B13) are a1-a100 -- it is -- for example, (a10000-a20000) -- it is -- ** -- it understands. Thus, about the perimeter of an optical disk, detection will be repeated, and the address in the periphery (location which can detect the tilt sensor C14) of an optical disk to the address of the inner circumference (made location which can detect the tilt sensor B13) of an optical disk will be synchronized and known. That is, Sheet A (inside-and-outside periphery address-mapping table) can be created. Drawing 4 is drawing showing Sheet A (inside-and-outside periphery address-mapping table).
[0025] In the inner circumference of an optical disk, since the degree of the inclination of an optical disk is generally small, it is stabilized and can perform informational read-out. Therefore, the inclination of the optical disk in the address (a1-a100) of inner circumference is known using read-out of the information from an optical disk, and the tilt sensor B13 located in inner circumference. That is, Sheet B (inner circumference address inclination conversion table) can be created. Drawing 5 is drawing showing Sheet B (inner circumference address inclination conversion table).
[0026] Moreover, the inclination in a periphery is known using the tilt sensor C14 located in the periphery of an optical disk synchronizing with detecting the inclination in inner circumference using the tilt sensor B13 located in the inner circumference of an optical disk. That is, Sheet C (inside-and-outside periphery inclination conversion table) can be created. Drawing 6 is drawing showing Sheet C (inside-and-outside periphery inclination conversion table).
[0027] Therefore, based on each conversion table of Sheet A (drawing 4), Sheet B (drawing 5), and

Sheet C (drawing 6), as shown in drawing 7 , the inclination of the optical disk of each of that location corresponding to the address of each part of the inner circumference of an optical disk is drawn. Moreover, synchronizing with the location (address) in inner circumference, the optical disk of each of that location corresponding to the address of each part in the periphery of an optical disk begins to incline similarly. In this way, Sheet D (inside-and-outside periphery address inclination conversion table) can be created. Drawing 7 is drawing showing Sheet D (inside-and-outside periphery address inclination conversion table).

[0028] Then, the readout of the information in the address ax of drawing 3 shall be performed as an example in the case of performing the readout of the information in a certain address on an optical disk. First, by performing a TOC lead shows the address of the optical disk of the physical location where the information on Address ax is indicated (when it is the example of drawing 3 , the address in ay and a periphery is similarly read for the address in inner circumference as az).

[0029] Next, with reference to the sheet D (drawing 7) created beforehand, the inclination by of the optical disk in the part over the address ay of inner circumference is known. Moreover, on the other hand, the inclination bz of the optical disk in the part over the address az of a periphery is known. Therefore, when distance of Address ax and Address ay is set to c and distance of Address ax and Address az is set to d (distance: c and d known), the inclination bx of the optical disk in Address ax is bx=(dxby+cxbz)/(c+d).

It is expressed by carrying out.

[0030] Therefore, the tilt servo motor 10 is used for instruction and coincidence "read information on the location of Address ax", and a gap of the plumbness of the optical axis of an objective lens 3 and the reflector of an optical disk is amended. As the approach of amendment, the main shaft 6 and the guide shaft 7 for migration of carriage 4 are moved to coincidence as usual. Or only an amount of inclinations called above bx carries out amendment actuation of the turntable 1.

[0031] As mentioned above, as explained in detail, based on the sheet D of the inclination information on the optical disk created beforehand (drawing 7), it becomes possible by performing amendment actuation of the inclination of this optical disk synchronizing with reading of information to perform read-out of the information from the stable optical disk.

[0032]

[Effect of the Invention] According to this invention, corresponding to the optical disk which has the gestalt of various curvatures, it detects as mentioned above by the tilt sensor B in which the inclination of an optical disk was prepared by inner circumference, and the tilt sensor C formed in the periphery. And from the detection result of the inclination in each location (address) of inner circumference and a periphery, the direction of the inclination of each part of an optical disk and the degree of an inclination can be calculated, and it can predict beforehand. In this way, it becomes possible to amend the gap with the optical axis of an objective lens, and the plumbness of the reflector of an optical disk, to be stabilized and to perform read-out of the information from an optical disk by driving a tilt servo motor according to the inclination of the location of the applicable address, and applying amendment based on the result of an operation predicted beforehand, at the same time it moves an objective lens, in order to reproduce the information on a certain address.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The perspective view of the optical disk unit in the gestalt of 1 operation of this invention
[Drawing 2] The flow chart which amends the inclination in the gestalt of 1 operation of this invention, and performs information read-out
[Drawing 3] Drawing showing the relation between the radius location of an optical disk, and the address
[Drawing 4] Drawing showing Sheet A (inside-and-outside periphery address-mapping table)
[Drawing 5] Drawing showing Sheet B (inner circumference address inclination conversion table)
[Drawing 6] Drawing showing Sheet C (inside-and-outside periphery inclination conversion table)
[Drawing 7] Drawing showing Sheet D (inside-and-outside periphery address inclination conversion table)
[Drawing 8] The perspective view of the conventional optical disk unit
[Drawing 9] The flow chart which amends the conventional inclination and performs information read-out
[Drawing 10] The detection optical-path Fig. of the conventional tilt sensor
[Drawing 11] The top view of the lens focal plane of drawing 10
[Drawing 12] The side elevation of drawing 10
[Drawing 13] Drawing showing the gestalt of the curvature of an optical disk
[Description of Notations]
1 Turntable
2 Shaft
3 Objective Lens
4 Carriage
5 Feed Motor
6 Main Shaft
7 Guide Shaft
8 Base
9 Tilt Sensor A
10 Tilt Servo Motor
11 Infrared Radiation LED
12 2 Division Photodetector
13 Tilt Sensor B
14 Tilt Sensor C
15 Signal Cable

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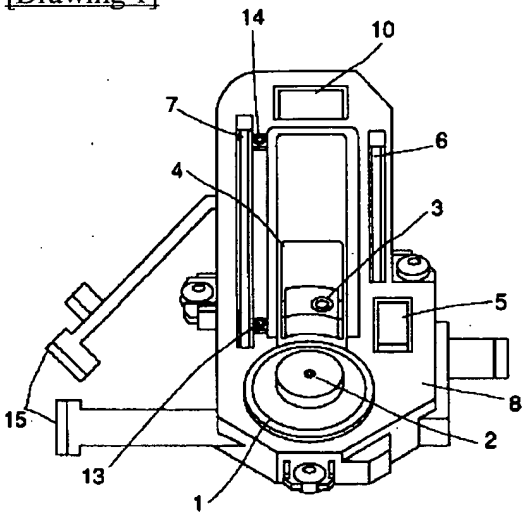
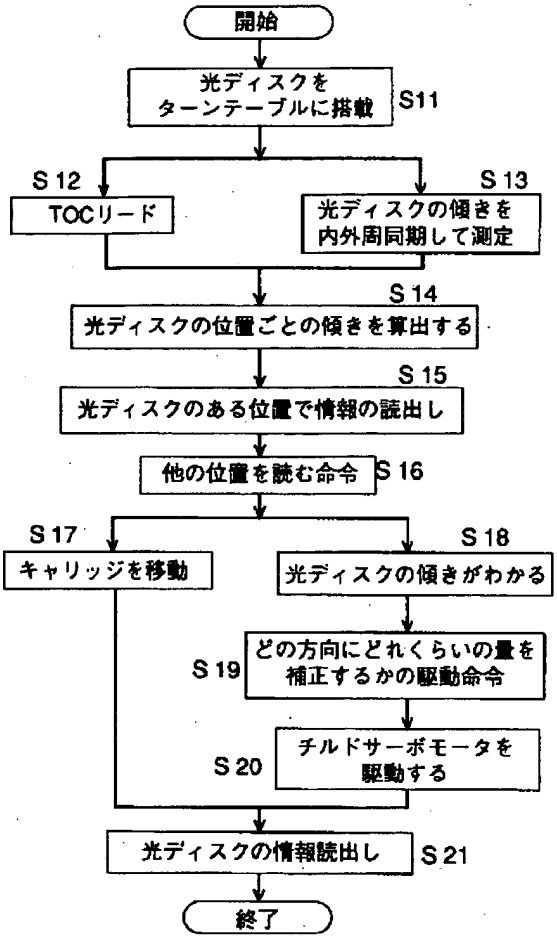
DRAWINGS

[Drawing 1]



[Drawing 2]



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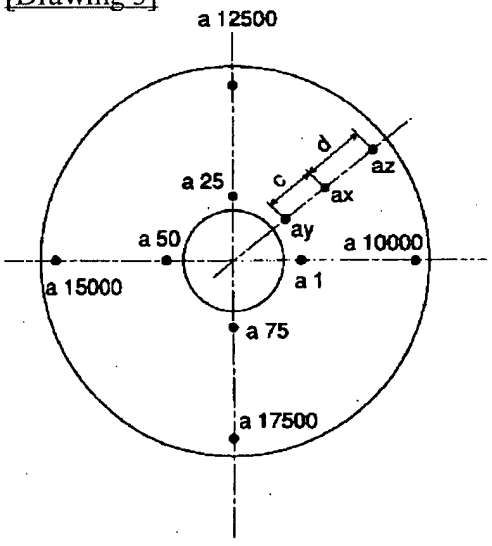
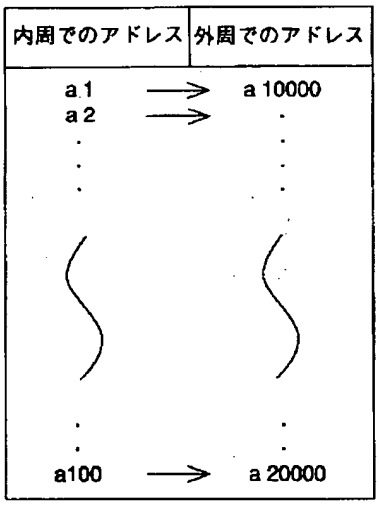


[Drawing 4]



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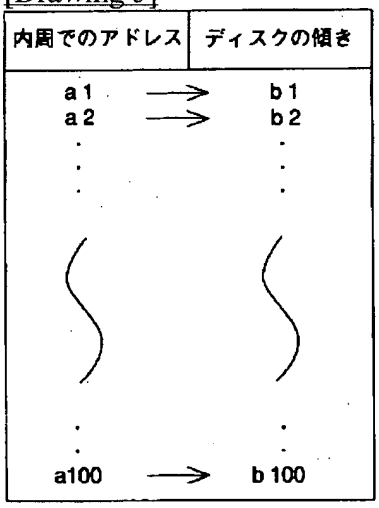
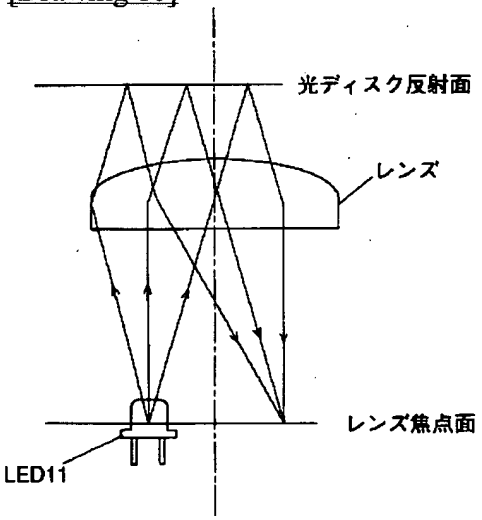


[Drawing 10]



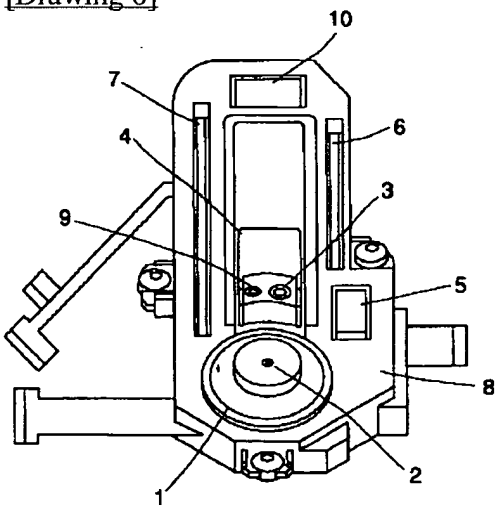
[Drawing 6]

チルトセンサ13で検知された内周でのディスクの傾き	チルトセンサ14で検知された外周でのディスクの傾き
b 1	b 10000
b 2	
b 100	b 20000

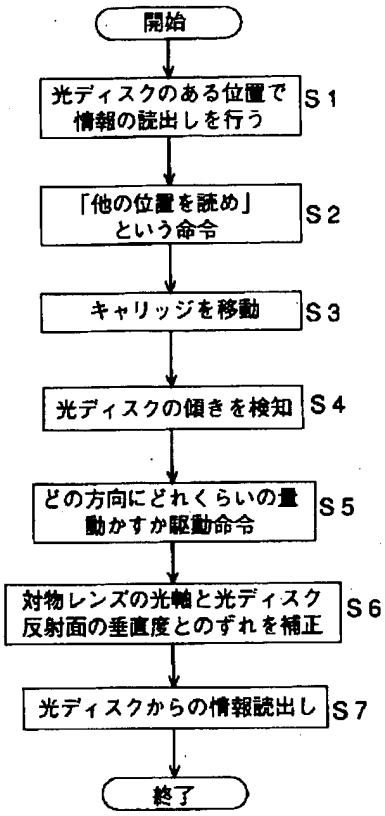
[Drawing 7]

内周でのアドレス	ディスクの傾き	外周でのアドレス	ディスクの傾き
a 1	b 1	a 10000	b 10000
a 2	b 2		
a100	b 100	a 20000	b 20000

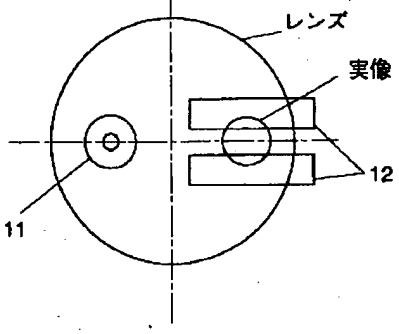
[Drawing 8]



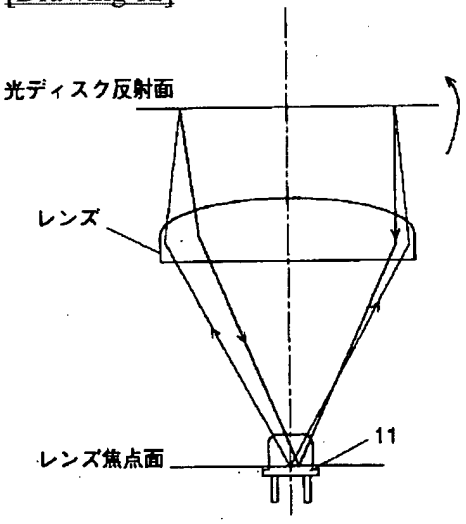
[Drawing 9]



[Drawing 11]

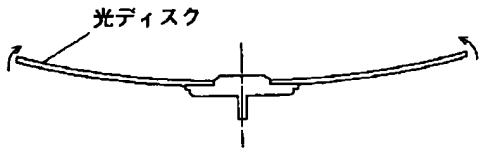


[Drawing 12]

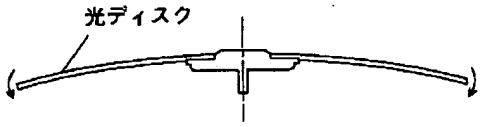


[Drawing 13]

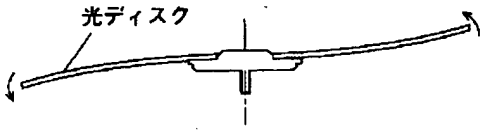
(a)



(b)



(c)



[Translation done.]